

Amendments to the Specification:

Please replace paragraph [0008] with the following amended paragraph:

[0008] In this piezoelectric element, attention was paid to a fact that use of a ceramic substrate impairs the densification of a piezoelectric portion, ~~and this~~ Thus, the piezoelectric element was accordingly improved in piezoelectric properties by means of obtaining a dense piezoelectric portion where a piezoelectric material made of a piezoelectric ceramic composition was previously heat-treated.

Please replace paragraph [0009] with the following amended paragraph:

[0009] In this piezoelectric element, however, it is necessary to use an inorganic or organic adhesive at the time of attaching the piezoelectric onto the ceramic substrate, ~~therefore~~ Therefore, there have been such problems that the adhesive impairs the vibration transmittability between the ceramic substrate and the piezoelectric or the adhesive components infiltrate into the piezoelectric or the ceramic substrate, deteriorating their properties.

Please replace paragraph [0014] with the following amended paragraph:

[0014] That is, according to the present invention, there is provided a piezoelectric element comprising: including a ceramic substrate, and a piezoelectric portion made of a piezoelectric ceramic composition containing a $\text{PbMg}_{1/3}\text{Nb}_{2/3}\text{O}_3$ - PbZrO_3 - PbTiO_3 ternary system solid solution composition having an average particle diameter of 1 – 10 μm with a maximum particle diameter being 5 times as large as the average particle diameter or less and being represented by the following general chemical formula ~~(1)~~ discussed below as a main component. The piezoelectric portion contains and 0.05 to 10.0 mass% of NiO , ~~and an~~ electrode;

~~wherein said~~ An electrode is electrically connected to ~~said the~~ piezoelectric portion, and ~~said the~~ piezoelectric portion is solidly attached to the ceramic substrate directly or via ~~said the~~ electrode.

Please replace paragraph [0015] with the following amended paragraph:

[0015] The piezoelectric ceramic composition is represented by the following general formula: $\text{Pb}_x(\text{Mg}_{y/3}\text{Nb}_{2/3})_a\text{Ti}_b\text{Zr}_c\text{O}_{3-z}$ —(1)

Please replace paragraph [0016] with the following amended paragraph:

[0016] wherein In the above general chemical formula the following are satisfied:

$0.95 \leq x \leq 1.05$; $0.8 \leq y \leq 1.0$; a, b and c are decimals falling in a range surrounded by (a,b,c) = (0.550, 0.425, 0.025), (0.550, 0.325, 0.125), (0.375, 0.325, 0.300), (0.100, 0.425, 0.475), (0.100, 0.475, 0.425) and (0.375, 0.425, 0.200) in the coordinates with coordinate axes of said a, b and c, and $a-b+c = 1.00$.

Please replace paragraph [0017] with the following amended paragraph:

[0017] According to the present invention, there is further provided a piezoelectric element ~~comprising: including~~ a ceramic substrate, ~~and~~ a plurality of piezoelectric ~~portion-portion~~s made of a piezoelectric ceramic composition containing a $\text{PbMg}_{1/3}\text{Nb}_{2/3}\text{O}_3$ - PbZrO_3 - PbTiO_3 ternary system solid solution composition represented by the ~~following general chemical formula (1)~~ discussed below as a main component, ~~and The plurality of piezoelectric portions contain~~ 0.05 to 10.0 mass% of NiO , and ~~include~~ a plurality of electrodes thereon;

~~wherein said The plurality of piezoelectric portion-portion~~s are laminated with interposing negative electrodes and positive electrodes of ~~said the~~ plurality of electrodes alternately in each gap between ~~said the~~ piezoelectric portions provided in stories and a lowermost piezoelectric portion is solidly attached to the ceramic substrate directly or via said electrode.

Please replace paragraph [0018] with the following amended paragraph:

[0018] The piezoelectric ceramic composition is represented by the following general formula: $\text{Pb}_x(\text{Mg}_{y/3}\text{Nb}_{2/3})_a\text{Ti}_b\text{Zr}_c\text{O}_{3-z}$ —(1)

Please replace paragraph [0019] with the following amended paragraph:

[0019] wherein In the above general chemical formula the following are satisfied $0.95 \leq x \leq 1.05$; $0.8 \leq y \leq 1.0$; a, b and c are decimals falling in a range surrounded by (a,b,c) = (0.550,

0.425, 0.025), (0.550, 0.325, 0.125), (0.375, 0.325, 0.300), (0.100, 0.425, 0.475), (0.100, 0.475, 0.425) and (0.375, 0.425, 0.200), in the coordinates with coordinate axes of said a, b and c, and $a+b+c = 1.00$.

Please replace paragraph [0021] with the following amended paragraph:

[0021] According to the present invention, there is still further provided a piezoelectric element ~~comprising including~~ a ceramic substrate, and a piezoelectric portion made of a piezoelectric ceramic composition containing a $\text{PbMg}_{1/3}\text{Nb}_{2/3}\text{O}_3$ - PbZrO_3 - PbTiO_3 ternary system solid solution composition represented by the following ~~general chemical~~ formula (1) discussed below as a main component. ~~and The plurality of piezoelectric portions contain~~ 0.05 to 10.0 mass% of NiO, and said piezoelectric ceramic composition ~~contain contains~~ particles having NiO as a main component on the surface and/or in the interior thereof, ~~and an electrode;~~

wherein said An electrode is electrically connected to ~~said the~~ piezoelectric portion, and said piezoelectric portion is solidly attached to the ceramic substrate directly or via ~~said the~~ electrode.

Please replace paragraph [0022] with the following amended paragraph:

[0022] The piezoelectric ceramic composition is represented by the following general formula: $\text{Pb}_x(\text{Mg}_{y/3}\text{Nb}_{2/3})_a\text{Ti}_b\text{Zr}_c\text{O}_3$ — (1)

Please replace paragraph [0023] with the following amended paragraph:

[0023] wherein In the above general chemical formula the following are satisfied: $0.95 \leq x \leq 1.05$; $0.8 \leq y \leq 1.0$; a, b and c are decimals falling in a range surrounded by (a,b,c) = (0.550, 0.425, 0.025), (0.550, 0.325, 0.125), (0.375, 0.325, 0.300), (0.100, 0.425, 0.475), (0.100, 0.475, 0.425) and (0.375, 0.425, 0.200), in the coordinates with coordinate axes of said a, b and c, and $a+b+c = 1.00$.

Please replace paragraph [0024] with the following amended paragraph:

[0024] Also, in a piezoelectric element where ~~this the~~ NiO ~~particle is~~ particles are present, it is preferable that a ternary system solid solution composition has an average particle diameter

of 1 – 10 μm with the maximum particle diameter being 5 times as large as the average particle diameter or less. In addition, a particle having NiO as the main component may include only NiO or NiO with MgO solid solution.

Please replace paragraph [0028] with the following amended paragraph:

[0028] According to the present invention, there is provided a method for producing a piezoelectric element ~~comprising including~~ the steps of: superposing a piezoelectric material containing a $\text{PbMg}_{1/3}\text{Nb}_{2/3}\text{O}_3$ - PbZrO_3 - PbTiO_3 ternary system solid solution composition represented by the following ~~general chemical~~ formula ~~(+)~~ discussed below as a main component ~~and, the piezoelectric material contains~~ 0.05 to 10.0 mass% of NiO on a ceramic substrate or on an electrode formed on the ceramic substrate, and ~~subjecting the superposed piezoelectric material to a thermal treatment in an atmosphere where 0.03 – 0.5 mg/cm³ (NiO conversion amount per unit volume of a space in a container) of a atmosphere-controlling material having the same composition as the piezoelectric material is coexisted.~~

Please replace paragraph [0029] with the following amended paragraph:

[0029] The piezoelectric material composition is represented by the following general formula: $\text{Pb}_x(\text{Mg}_{y/3}\text{Nb}_{2/3})_z\text{Ti}_b\text{Zr}_c\text{O}_{3z}$ — (+)

Please replace paragraph [0030] with the following amended paragraph:

[0030] wherein in the above general chemical formula the following are satisfied: $0.95 \leq x \leq 1.05$; $0.8 \leq y \leq 1.0$; a, b and c are decimals falling in a range surrounded by (a,b,c) = (0.550, 0.425, 0.025), (0.550, 0.325, 0.125), (0.375, 0.325, 0.300), (0.100, 0.425, 0.475), (0.100, 0.475, 0.425) and (0.375, 0.425, 0.200), in the coordinates with coordinate axes of said a, b and c, and $a+b+c = 1.00$.

Please replace paragraph [0031] with the following amended paragraph:

[0031] A method for producing a piezoelectric element ~~comprising includes~~ the steps of: superposing a piezoelectric material containing a $\text{PbMg}_{1/3}\text{Nb}_{2/3}\text{O}_3$ - PbZrO_3 - PbTiO_3 ternary system solid solution composition represented by the following ~~general chemical~~ formula ~~(+)~~ discussed below as a main component ~~and, the piezoelectric material contains~~ 0.05 to 10.0

mass% of NiO on a ceramic substrate or on an electrode formed on the ceramic substrate, and subjecting the superposed piezoelectric material to a thermal treatment in an atmosphere; wherein $0.03 - 0.5 \text{ mg/cm}^3$ (NiO conversion amount per unit volume of a space in a container) of a atmosphere-controlling material having the same composition as the piezoelectric material is coexisted as a container for housing said electrode on which the piezoelectric material is superposed and a setter for mounting the piezoelectric material thereon.

Please replace paragraph [0032] with the following amended paragraph:

[0032] The piezoelectric material composition is represented by the following general formula: $\text{Pb}_x(\text{Mg}_{y/3}\text{Nb}_{2/3})_a\text{Ti}_b\text{Zr}_c\text{O}_{3z} \text{---} (1)$

Please replace paragraph [0033] with the following amended paragraph:

[0033] wherein In the above general chemical formula the following are satisfied: $0.95 \leq x < 1.05$; $0.8 \leq y \leq 1.0$; a, b and c are decimals falling in a range surrounded by (a,b,c) = (0.550, 0.425, 0.025), (0.550, 0.325, 0.125), (0.375, 0.325, 0.300), (0.100, 0.425, 0.475), (0.100, 0.475, 0.425) and (0.375, 0.425, 0.200), in the coordinates with coordinate axes of said a, b and c, and $a+b+c = 1.00$.

Please replace the heading with the following amended heading:

Detailed Description of Preferred Embodiments the Invention

Please replace paragraph [0035] with the following amended paragraph:

[0035] Embodiments of the present invention are described below with referring reference to the drawings.

Please replace paragraph [0045] with the following amended paragraph:

[0045] The piezoelectric portion 1 used in the present invention is made of a piezoelectric ceramic composition composed mainly of a $\text{PbMg}_{1/3}\text{Nb}_{2/3}\text{O}_3$ - PbZrO_3 - PbTiO_3 ternary system solid solution composition represented by the following general chemical formula (1) shown below and containing 0.05 – 10.0 mass% of NiO.

Please replace paragraph [0046] with the following amended paragraph:

[0046] The piezoelectric ceramic composition is represented by: $\text{Pb}_x(\text{Mg}_{y/3}\text{Nb}_{2/3})_a\text{Ti}_b\text{Zr}_c\text{O}_3$ —
(†)

Please replace paragraph [0047] with the following amended paragraph:

[0047] wherein ~~In the above general chemical formula the following are satisfied:~~ $0.95 \leq x \leq 1.05$; $0.8 \leq y \leq 1.0$; a, b and c are decimals falling in a range surrounded by (a,b,c) = (0.550, 0.425, 0.025), (0.550, 0.325, 0.125), (0.375, 0.325, 0.300), (0.100, 0.425, 0.475), (0.100, 0.475, 0.425) and (0.375, 0.425, 0.200) in the coordinates with coordinate axes of said a, b and c, and $a+b+c = 1.00$.

Please replace paragraph [0049] with the following amended paragraph:

[0049] The reason why, in the above general formula (†), that a, b and c are made to be within the aforementioned specific range, is that, if a, b and c ~~being without~~ are outside of the range, there occurs a ~~cause~~ deterioration in flexural displacement of the piezoelectric element and linearity of a flexural displacement relative to an electric field. Likewise, the reason why the NiO content in the piezoelectric ceramic composition is 0.05 to 10.0 mass% is that the NiO content in the piezoelectric ceramic composition of less than 0.05 mass% causes insufficient densification, thereby causing deterioration in flexural displacement of the piezoelectric element and linearity of a flexural displacement relative to an electric field. On the other hand, when the NiO content exceeds 10.0 mass%, the piezoelectric portion has a higher reactivity with the substrate, which also causes deterioration in flexural displacement of the piezoelectric element and linearity of a flexural displacement relative to an electric field.

Please replace paragraph [0084] with the following amended paragraph:

[0084] That is, first, a raw material which serves as the main component of the piezoelectric ceramic ~~composition~~ composition is prepared by mixing simple substances (elements) each consisting of Pb, Ba, Ca, Sr, La, Mg, Nb, Zr or Ti; oxides of these elements (e.g. PbO , Pb_3O_4 , La_2O_3 , MgO , Nb_2O_5 , TiO_2 and ZrO_2); carbonates of these elements (e.g. BaCO_3 , SrCO_3 , MgCO_3 and CaCO_3); and compounds containing a plurality of these elements (e.g. MgNb_2O_6)

so that the contents of elements (Pb, Ba, Ca, Sr, La, Mg, Nb, Zr and Ti) in resulting mixture becomes within a desired ratio shown by the above-discussed general formula(1). The raw material has an average particle diameter of preferably 1 μm or less, more preferably 0.5 μm or less in the point that they can easily be uniformly mixed.